Hazard ID	Situational Analysis		
	Operational Mode	**Operational Scenario**	**Environmental Details**
HA-001	Normal Driving	Highway	Rain (slippery road)
HA-002	Normal Driving	Country Road	Normal Condition
HA-003	Normal Driving	Road with construction site	Normal Condition
HA-004	Normal Driving	Road with construction site	Normal Condition

Situation Details	Other Details (optional)	Item Usage (function)	Situation Description
High Speed		Correctly Used	Normal driving on a highway during rain at hight speed
High Speed		Incorrectly used	The driver is misusing the lane keeping assistance function as an autonomous function.
High speed		Correctly Used	Normal driving on a road with construction site at high speed
High speed		Correctly Used	Normal driving on a road with construction site at high speed

Hazard Identification

Function	Deviation	Deviation Details	Hazardous Event (resulting effect)
Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	Actor effect is too much	The LDW function applies an oscillating torque with very high torque (above limit).	Collision with other vehicle
Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane.	Function always activated	LKA function is always activated without any requirement for the driving to keep their hands on the steering wheel.	Collision with other vehicle
Lane Departure Warning (LDW) function shall apply an oscillating steering torque to provide the driver with haptic feedback	Function unexpectedly activated	Camera subsystem fail to pick correct lane and LDW function incorrectly vibrates the steering wheel	Collision with other vehicle
Lane Keeping Assistance (LKA) function shall apply the steering torque when active in order to stay in ego lane.	Function unexpectedly activated	Camera subsystem fail to pick correct lane and LKA incorrectly attempts to stay on the incorrect lane.	Collision with other vehicle

| | Hazardous Event | |
Event Details	Hazardous Event Description	Exposure (of situation)
High torque (above a limit) can cause the steering wheel to oscillate and the drive to lose control of the vehicle.	LDW apply a high torque on a slippery wet road at high speed driving	E2
The driver is misusing the lane keeping assistance function as an autonomous function and collides with another vehicle as he does not observe the traffic.	LKA is active and the driver is not required to keep hands on steering wheel.	E3
Camera subsystem generates a faulty signal (due to construction site lane markings) and the driver is alerted, this might cause a human error and a collision with another vehicle	LDW issues an incorrect warning which distracts the driver.	E2
Camera subsystem generates a faulty signal (due to construction site lane markings) and the LKA attempts to follow an incorrect lane which results in a deviations and a collision	LKA attempts to follow an incorrect lane	E2

Classification

Rationale (for exposure)	Severity (of potential harm)	Rationale (for severity)	Controllability (of hazardous event)
Driving on a rainy highway doesn't occur on a daily basis	S3	Losing control of the vehicle on high speeds on a highway can cause fatal injuries	C2
This scenario occurs can occur on a daily basis for all drivers.	S3	Losing control of the vehicle on high speeds on a highway can cause fatal injuries	C1
Driving on a constructions site is not a common event	S3	Departing a lane on high speeds on a construction site can cause fatal injuries	C0
Driving on a constructions site is not a common event	S3	Departing a lane on high speeds on a construction site can cause fatal injuries	C1

Rationale (for exposure)	Severity (of potential harm)	Rationale (for severity)	Controllability (of hazardous event)

	Determination of ASIL and Safety Goals	
Rationale (for controllability)	**ASIL Determination**	**Safety Goal**
The driver can take control of the steering wheel	ASIL A	The LDW function shall be torque limited to avoid oscillations and loss of control.
The majority of drivers will be able to regain control of the vehicle.	ASIL B	The LKA function shall be time limited and the additional steering torque shall end after a given time interval so that the driver cannot misuse the system as an autonomous driving feature.
Controllable in general	QM	The LDW function shall not be active in case of a camera subsystem malfunction
The majority of drivers will be able to regain control of the vehicle.	ASIL B	The LKA function shall not be active in case of a camera subsystem malfunction

EXAMPLE DISCUSSED IN THE PROJECT INSTRUCTIONS - Head

Hazard ID	
	Operational Mode
HA-001	Normal Driving

MORE EXAMPLES - Headlamp System

Hazard ID	
	Operational Mode
HA-001	OM03 - Normal Driving
HA-002	OM03 - Normal Driving
HA-003	OM03 - Normal Driving
HA-004	OM03 - Normal Driving
HA-005	OM03 - Normal Driving

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Operational Scenario	Environmental Details
City Road	Normal Conditions

Operational Scenario	Environmental Details
OS01 - City Road	EN01 - Normal conditions
OS01 - City Road	EN04 - Snowfall (degraded view)
OS03 - Highway	EN04 - Snowfall (degraded view)
OS02 - Country Road	EN01 - Normal conditions
OS02 - Country Road	EN04 - Snowfall (degraded view)

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ituational Analysis

Situation Details (optional)	Other Details (optional)	Item Usage (function)
Low Speed	Night time + Obstacle on the	Correctly Used

Situation Analysis

Situation Details (optional)	Other Details (optional)	Item Usage (function)
SD03 - Low speed	Night time + Obstacle on the	IU01 - Correctly used
SD03 - Low speed	Night time + Obstacle on the	IU01 - Correctly used
SD03 - High speed	Night time + Obstacle on the	IU01 - Correctly used
SD02 - High speed	Night time + Oncoming	IU01 - Correctly used
SD04 - High speed	Night time + Obstacle on the	IU01 - Correctly used

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Situation Description	Function
Normal Driving on a City Road in Normal	Low beam illuminates the

Situation Description	Function
Normal Driving on City Road during Normal	Low beam illuminates the
Normal Driving on City Road during Snowfall	Low beam illuminates the
Normal Driving on Highway during Snowfall	Low beam illuminates the
Normal Driving on Country Road during Normal	Low beam illuminates the
Normal Driving on Country Road during Snowfall	Low beam illuminates the

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Deviation	Deviation Details
Function not activated	Both headlights stop working

Deviation	Deviation Details
DV01 - Function not activated	Both headlights stop working
DV01 - Function not activated	Both headlights stop working
DV01 - Function not activated	Both headlights stop working
DV01 - Function not activated	Both headlights stop working
DV01 - Function not activated	Both headlights stop working

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entification

Hazardous Event (resulting effect)	Event Details	Hazardous Event Description
Front collision with obstacle	Vehicle crashes into the	Total loss of low beam

entification

Hazardous Event (resulting effect)	Event Details	Hazardous Event Description
EV04 - Front collision with obstacle	Vehicle crashes into the	Total loss of low beam
EV04 - Front collision with obstacle	Vehicle crashes into the	Total loss of low beam
EV04 - Front collision with obstacle	Vehicle crashes into the	Total loss of low beam
EV08 - Collision with other vehicle	Vehicle crashes into the	Total loss of low beam
EV04 - Front collision with obstacle	Vehicle crashes into the	Total loss of low beam

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Exposure (of situation)	Rationale (for exposure)
E4 - High probability	night driving in the city is a regular

Exposure (of situation)	Rationale (for exposure)
E4 - High probability	night driving in the city is a regular
E1 - Very low probability	night driving in the city on
E2 - Low probability	High driving is part of regular
E4 - High probability	country driving is part of regular
E2 - Low probability	country driving is part of regular

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Hazardous

Severity (of potential harm)
S1 - Light and moderate injuries

Hazardous

Severity (of potential harm)
S1 - Light and moderate injuries
S1 - Light and moderate injuries
S3 - Life-threatening or fatal injuries
S3 - Life-threatening or fatal injuries
S3 - Life-threatening or fatal injuries

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s Event Classification

Rationale (for severity)	Controllability (of hazardous event)
In city traffiic, speed of vehicle is expected to be low	C0 - Controllable in general

s Event Classification

Rationale (for severity)	Controllability (of hazardous event)
In city traffiic, speed of vehicle is expected to be low	C0 - Controllable in general
In city traffiic, speed of vehicle is expected to be low	C1 - Simply controllable
On highway speed of vehicle is expected to be high	C2 - Normally controllable
On country roads speed of vehicle is expected to be high	C1 - Simply controllable
On country roads speed of vehicle is expected to be high	C3 - Difficult to control or uncontrollable

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	Determination of ASIL and
Rationale **(for controllability)**	**ASIL** **Determination**
At city speed, most drivers will be able to	QM

	Determination of ASIL and
Rationale **(for controllability)**	**ASIL** **Determination**
At city speed, most drivers will be able to	QM
On completely unilluminated city roads,	QM
When driving on highway with low beam, it	A
Since there is usually no other form of	B
Since there is usually no other form of	B

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Safety Goals						
Safety Goal						
Total Loss of Beam Shall						
Safety Goals						
Safety Goal						
Total loss of low beam						
Total loss of low beam						
Total loss of low beam						
Total loss of low beam						
Total loss of low beam						

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Hazard & Risk Analysis Definiti

Operational Mode

ID	Mode
OM01	Parked
OM02	Ignition on
OM03	Normal driving
OM04	Backward driving
OM05	Degraded driving
OM06	Towing (active)
OM07	Towing (passive)
OM08	Service
OM09	N/A

Operational Scenario

ID	Scenario
OS01	Any Road
OS02	City Road
OS03	Country Road
OS04	Highway
OS05	Mountain Pass
OS06	Off Road
OS07	Road with gradient
OS08	Road with bump
OS09	Road tunnel
OS10	Road with construction site
OS11	N/A

Situation Details

ID	Scenario
SD01	Low speed
SD02	High speed
SD03	Normal acceleration
SD04	High acceleration
SD05	Normal braking
SD06	High braking
SD07	N/A

Item Usage

ID	Mode
IU01	Correctly used
IU02	Incorrectly used
IU03	N/A

Environmental Details

ID	Scenario
EN01	Normal conditions
EN02	Sun blares (degraded view)
EN03	Fog (degraded view)
EN04	Snowfall (degraded view)
EN05	Cross-wind (lateral force)
EN06	Rain (slippery road)
EN07	Snow (slippery road)

EN08	Glace (slippery road)
EN09	N/A

Remarks
Car is parked, ignition is off
Car is parked, ignition is on
Car is driving
Car is driving
Limp home mode
Towing another car
Beeing towed by another car
Vehicle is in repair garage
not applicable or not relevant

Remarks
road type
road type
road type
road type
road type
road type
road attribute
road attribute
road attribute
road attribute
not applicable or not relevant

Remarks
driving attribute
driving attribute
driving attribute
driving attribute
driving attribute
driving attribute
not applicable or not relevant

Remarks
Intended usage
Unintended usage (foreseeable)
not applicable or not relevant

Remarks
weather attribute
weather attribute
weather attribute
weather attribute
weather attribute
road attribute
road attribute

road attribute
not applicable or not relevant

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Reference	
OM01 - Parked	
OM02 - Ignition on	
OM03 - Normal driving	
OM04 - Backward driving	
OM05 - Degraded driving	
OM06 - Towing (active)	
OM07 - Towing (passive)	
OM08 - Service	
OM09 - N/A	

Reference	
OS01 - Any Road	
OS02 - City Road	
OS03 - Country Road	
OS04 - Highway	
OS05 - Mountain Pass	
OS06 - Off Road	
OS07 - Road with gradient	
OS08 - Road with bump	
OS09 - Road tunnel	
OS10 - Road with construction site	
OS11 - N/A	

Reference	
SD01 - Low speed	
SD02 - High speed	
SD03 - Normal acceleration	
SD04 - High acceleration	
SD05 - Normal braking	
SD06 - High braking	
SD07 - N/A	

Reference	
IU01 - Correctly used	
IU02 - Incorrectly used	
IU03 - N/A	

Reference	
EN01 - Normal conditions	
EN02 - Sun blares (degraded view)	
EN03 - Fog (degraded view)	
EN04 - Snowfall (degraded view)	
EN05 - Cross-wind (lateral force)	
EN06 - Rain (slippery road)	
EN07 - Snow (slippery road)	

EN08 - Glace (slippery road)	
EN09 - N/A	

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Deviation

ID	Deviation (Guideword)
DV01	Function not activated
DV02	Function unexpectedly activated
DV03	Function always activated
DV04	Actor effect is too much
DV05	Actor effect is too less
DV06	Actor action too early
DV07	Actor action too late
DV08	Actor action before
DV09	Actor action after
DV10	Actor effect is reverse
DV11	Actor effect is wrong
DV12	Sensor sensitivity is too high
DV13	Sensor sensitivity is too low
DV14	Sensor detection too early
DV15	Sensor detection too late
DV16	Sensor detection before
DV17	Sensor detection after
DV18	Sensor detection is reverse
DV19	Sensor detection is wrong
DV20	N/A

Hazardous Events (possibe effects)

ID	Hazardous Event
EV-07	None
EV-06	Front collision with oncoming traffic
EV-05	Front collision with ahead traffic
EV-04	Front collision with obstacle
EV-03	Rear collision with trailing traffic
EV-02	Side collision with other traffic
EV-01	Side collision with obstacle
EV00	Collision with other vehicle
EV01	Collision with train
EV02	Collision with pedestrian
EV03	Car spins out of control
EV04	Car comes off the road
EV05	Car catches file
EV06	N/A

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Remarks	Reference
Activation error	DV01 - Function not activated
Activation error	DV02 - Function unexpectedly activated
Activation error	DV03 - Function always activated
Quantitative error	DV04 - Actor effect is too much
Quantitative error	DV05 - Actor effect is too less
Timing error	DV06 - Actor action too early
Timing error	DV07 - Actor action too late
Sequence error	DV08 - Actor action before
Sequence error	DV09 - Actor action after
Logical error	DV10 - Actor effect is reverse
Logical error	DV11 - Actor effect is wrong
Quantitative error	DV12 - Sensor sensitivity is too high
Quantitative error	DV13 - Sensor sensitivity is too low
Timing error	DV14 - Sensor detection too early
Timing error	DV15 - Sensor detection too late
Sequence error	DV16 - Sensor detection before
Sequence error	DV17 - Sensor detection after
Logical error	DV18 - Sensor detection is reverse
Logical error	DV19 - Sensor detection is wrong
not applicable or not relevant	DV20 - N/A

Remarks	Reference
	EV-07 - None
	EV-06 - Front collision with oncoming traffic
	EV-05 - Front collision with ahead traffic
	EV-04 - Front collision with obstacle
	EV-03 - Rear collision with trailing traffic
	EV-02 - Side collision with other traffic
	EV-01 - Side collision with obstacle
	EV00 - Collision with other vehicle
	EV01 - Collision with train
	EV02 - Collision with pedestrian
	EV03 - Car spins out of control
	EV04 - Car comes off the road
	EV05 - Car catches file
	EV06 - N/A

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Exposure	
ID	**Description**
E0	Incredible
E1	Very low probability
E2	Low probability
E3	Medium probability
E4	High probability

Severity	
ID	**Description**
S0	No injuries
S1	Light and moderate injuries
S2	Severe and life-threatening injuries
S3	Life-threatening or fatal injuries

Controllability	
ID	**Description**
C0	Controllable in general
C1	Simply controllable
C2	Normally controllable
C3	Difficult to control or uncontrollable

Duration (of situation)
Not specified
<1 % of average operating time
1 % to 10 % of average operating time
>10 % of average operating time

Remarks
No injuries
Light and moderate injuries
Severe and life-threatening injuries (survival probable)
Life-threatening injuries (survival uncertain), fatal injuries

Remarks
Controllable in general
99 % or more of all drivers or other traffic participants are usually able
90 % or more of all drivers or other traffic participants are usually able
Less than 90 % of all drivers or other traffic participants are usually ab

Frequency (of situation)
Occurs less often than once a year for the great majority of drivers
Occurs a few times a year for the great majority of drivers
Occurs once a month or more often for an average driver
Occurs during almost every drive on average

Probability of Injuries
AIS 0 and less than 10 % probability of AIS 1-6
More than 10 % probability of AIS 1-6 (and not S2 or S3)
More than 10 % probability of AIS 3-6 (and not S3)
More than 10 % probability of AIS 5-6

Reference			
Reference			
E0 - Incredible			
E1 - Very low probability			
E2 - Low probability	4		
E3 - Medium probability			
E4 - High probability			
Reference			
S0 - No injuries			
S1 - Light and moderate injuries			
S2 - Severe and life-threatening injuries			
S3 - Life-threatening or fatal injuries			
Reference			
C0 - Controllable in general			
C1 - Simply controllable			
C2 - Normally controllable			
C3 - Difficult to control or uncontrollable			

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	Controllability	Exposure	Sev...	
			S0	S1
	C1	E1	QM	QM
		E2	QM	QM
		E3	QM	QM
		E4	QM	QM
	C2	E1	QM	QM
		E2	QM	QM
		E3	QM	QM
		E4	QM	A
	C3	E1	QM	QM
		E2	QM	QM
		E3	QM	A
		E4	QM	B

erity	
S2	S3
QM	QM
QM	QM
QM	A
A	B
QM	QM
QM	A
A	B
B	C
QM	A
A	B
B	C
C	D